~~Specification~~

ACTUATION FORCE TRANSMISSION MECHANISM AND STRADDLE-TYPE VEHICLE

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a U.S. National Phase of International Application No. PCT/JP2005/011804, filed June 28, 2005, which claims priority to Japanese Application No. 2004-195632, filed July 1, 2004, each of which is hereby incorporated by reference in its entirety.

BACKGROUND OF THE INVENTION

Field of the Invention

[0002] ~~[0001]~~

~~The~~ The present invention relates generally to an actuation force transmission mechanisms utilizable with a straddle-type vehicle, and more specifically, to an actuation force transmission mechanism ~~for~~ operative to transmit~~ting~~ actuation force of a shift actuator to a shift shaft~~, provided in~~ of a shift control device ~~for a straddle-type vehicle~~ for electric~~ically controlling~~ control of ~~changing~~ speed changes~~, and relates to a straddle-type vehicle~~.

Description of the Related Art

[0003]

~~Background Art~~

~~[0002]~~

~~In~~ In some electric shift control devices, a conventional foot-operated shift pedal is not used, but a shift actuator (electric motor) is actuated based on a speed change command signal that is output from a shift switch to rotate the shift shaft of a transmission for shift change.

[0004] ~~[0003]~~

~~In~~ In the case of shift change using a foot-operated shift pedal, repeated shift operations may be required to complete the shift change ~~when~~ if a dog in the transmission

~~cannot be~~ does not disengaged or engaged smoothly~~, repeated shift operations can eventually complete the shift change~~. However, with an electric shift control device, the shift change might not be made ~~when~~ if a dog ~~cannot be~~ does not disengaged or engaged smoothly~~, smooth shift change cannot occasionally be made~~.

[0005] ~~[0004]~~

~~In~~ an attempt to address ~~such a~~this problem related to electric shift control devices, a feedback method has been proposed. According to this method, ~~to feed back~~ the angle of a shift cam is detected and fed back in order to adjust the operation angle of the shift actuator for ensuring that the dog properly and smoothly disengages and engages ~~smoothly~~. Although beneficial, ~~T~~this method ~~has the problem~~ can be problematic due to ~~of~~ slow shift speed and the complexity of the device.

[0006] This method is also problematic because in order

~~[0005]~~

~~T~~to operate the shift actuator ~~to~~ at a predetermined angle in a predetermined period, the shift actuator must keeps operating even during abutment of the dog. Due to the abutment with the shift actuator~~, and hence it is not possible to prevent~~ the dog may tend to ~~from~~ rotate~~ing~~ with the operation of the shift actuator. ~~It~~ Although it is possible to prevent the dog from rotating with the operation of the shift actuator, this requires the ~~by, for example,~~ interposition of~~ng~~ an actuation force transmission mechanism, such as ~~including~~ a spring between the shift actuator and the shift shaft. ~~However~~Further, if the load required to disengage the dog cannot be obtained with the spring, the problem arises that the dog cannot be disengaged. In addition, if the stroke amount of the shift actuator needs to be increased, ~~and~~ the shift speed is made slower.

[0007] ~~[0006]~~

~~In~~ view of the foregoing issues, Japanese Patent Document No. JP-B-3044498 ~~Patent Document 1~~ discloses a technique for providing an actuation force transmission mechanism (i.e., a lost motion mechanism) constituted of an elastic member between the shift actuator and the shift shaft. This lost motion mechanism is interposed between a speed reduction gear mechanism (~~,~~ which is ~~provided~~ positioned between the output shaft and the shift shaft of the shift actuator~~,~~) and the shift shaft in order to prevent the

shift actuator from being overloaded. Thus, instead of being applied to the shift actuator, any overload ~~After~~ is applied to the elastic member and results in elastic deformation of the elastic member ~~is overloaded and hence elastically deformed~~. Therefore, when the shift shaft is rotationally driven by the resilient force, the shift shaft can be rotationally driven smoothly, without the influence of the inertial mass of the speed reduction gear mechanism. Such a configuration tends to ~~, which allows~~ ensure smooth speed change shift operation.

[0008] ~~[0007]~~

~~Incidentally,~~ albeit unrelated to electric shift control devices, Japanese Patent Document No. JP-Y-Sho 43-11555 ~~Patent Document 2~~ discloses a technique for achieving smooth shift change using a foot-operated shift pedal~~, though not related to an electric shift control device~~. ~~Specifically~~This reference teaches~~,~~ a coupling mechanism that is disconnected at a portion between the shift pedal and the shift shaft. ~~, and b~~Both the disconnected ends of the coupling mechanism are linked via an elastic member and have ~~with~~ play equivalent to half the stroke of the shift pedal. With this structure, the dog can be disengaged with operation force of the shift pedal directly applied thereto, and can also be engaged always by the elastic force of the elastic member. This configuration tends to ensure~~, which allows~~ smooth shift change for foot-operated shift pedals.

[0009] Despite the beneficial shift control devices described in Japanese Patent Document Nos. JP-B-3044498 and JP-Y-Sho 43-11555, the described actuation force transmission mechanisms, including the elastic member of JP-B-3044498, are both the rotary type and tend to be large in size and restricted in terms of installation location. This restriction on installation location also causes the problem of significant restriction on the layout of the shift actuator. Therefore, there is a need in the art for an actuation force transmission mechanism that allows smooth shift change and is compactly sized in order to mitigate any restriction on installation location and enable easy installation.

~~Patent Document 1: JP-B-3044498~~

~~Patent Document 2: JP-Y-Sho 43-11555~~

SUMMARY OF THE INVENTION

[0010] One aspect of the present invention involves an ~~As described herein, embodiments of the~~ actuation force transmission mechanism that ~~can~~ allows for smooth shift changes even when disengagement of the dog is difficult or when dog abutment occurs during engagement of the dog. As such, when incorporated into a vehicle, the actuation force transmission mechanism ~~The embodiments described herein can thus~~ provides for a smooth-shifting of the ~~straddle-type~~ vehicle's speed transmission. ~~incorporating the actuation force transmission mechanism.~~

[0011] ~~According to an embodiment~~~~Disclosure of the Invention~~

~~Problem to be Solved by the Invention~~

~~[0008]~~

~~The actuation force transmission mechanisms including an elastic member described in Patent Document 1 and Patent Document 2 above, however, are both the rotary type, and hence large in size and restricted in terms of installation location. The restriction on the installation location also causes the problem of significant restriction on the layout of the shift actuator.~~

~~[0009]~~

~~The present invention has been made in view of the foregoing, and therefore has an object to provide an actuation force transmission mechanism allowing smooth shift change and easy installation.~~

~~Means for Solving the Problem~~

~~[0010]~~

~~The present invention, provides an~~The actuation force transmission mechanism ~~is~~can be provided in a shift control device for a straddle-type vehicle for performing shift control by stroking ~~in which~~ a shift actuator ~~is stroked~~ by a predetermined amount in order to rotate a shift shaft. The mechanism can includes: ~~a~~ first coupling part and a second coupling part that can be coupled together for relative movement in linear directions; a biasing mechanism ~~n urging means~~ for urging the first and second coupling parts toward a neutral position; and a stopper mechanism for stopping the relative movement of the first or second coupling part when the first or second coupling part is moved ~~relatively~~ from

the neutral position against an urging force of the ~~urging means~~biasing mechanism. The actuation force transmission mechanism ~~is~~ can be interposed between the shift actuator and the shift shaft.

[0012] ~~[0011]~~

~~In a preferred another~~a preferred embodiment, the actuation force transmission mechanism ~~is~~ can be arranged such that~~,~~ when resistive force acts against movement of the actuation force transmission mechanism~~,:~~ one of the first ~~or~~ and second coupling parts moves relatively against the urging force of the ~~urging means~~biasing mechanism until the respective ~~first or second~~ coupling part is stopped by the stopper mechanism. Thereafter~~Further, ; and then~~ the first and second coupling parts can then move together with further movement in the same direction.

[0013] ~~[0012]~~

~~In a preferred~~ yet another embodiment, the first coupling part and the second coupling part ~~are~~ can respectively comprise ~~constituted of~~ a rod and a cylindrical member for ~~accommodating~~receiving at least a part of the rod.

~~[0013]~~

~~In~~ yet another ~~preferred~~ embodiment, the ~~urging means~~biasing mechanism can includes a coil spring. ~~, and~~ The coil spring can be ~~is~~ disposed between the rod and the cylindrical member.

~~[0014]~~

For use with a spring so disposed, ~~In this regard~~Preferably, the rod ~~has~~ can have portions of different diameters, and ~~, and~~ a portion of a large diameter ~~is~~ can be used as a part contacted by the spring.

[0014] ~~[0015]~~

~~In a preferred~~ another embodiment, the cylindrical member ~~has~~ can have a step on its inner surface, and the step ~~is~~ can be used as a part of the stopper mechanism.

~~[0016]~~

~~In a preferred embodiment, t~~The cylindrical member ~~is~~ can comprise ~~constituted with~~ a plurality of members having inner and outer surfaces. ~~The~~

~~[0017]~~

~~In a preferred embodiment, the c~~cylindrical member can includes a plurality of cylindrical ~~members~~segments.

[0015] ~~[0018]~~

~~In~~ In yet another ~~a preferred~~ embodiment, the first coupling part and the second coupling part ~~are~~ can be arranged such that their distal ends overlap each other in linear directions.

[0016] ~~[0019]~~

~~In~~ In yet another ~~a preferred~~ embodiment, the shift actuator ~~is~~ can be coupled to the shift shaft via a coupling rod. Additionally, ~~and~~ the actuation force transmission mechanism ~~is~~ can be disposed at an intermediate portion of the coupling rod.

~~[0020]~~

~~Preferably~~, the actuation force transmission mechanism ~~is~~ can be provided in a case held by the coupling rod. ~~Furthermore,~~

~~[0021]~~

~~Preferably, t~~the actuation force transmission mechanism ~~is~~ can be disposed outside an engine case.

[0017] The actuation force transmission mechanism can be constructed to slide in linear directions. Thus, the actuation force transmission can be compact in size and facilitate the choice of the installation location. Thus, the position of the shift actuator relative to the shift shaft can be determined arbitrarily.

~~[0022]~~

~~The present invention provides a straddle type vehicle incorporating the actuation force transmission mechanism constructed as described above.~~

~~Effect of the Invention~~

~~[0023]~~

~~The actuation force transmission mechanism of the present invention allows smooth shift change even when disengagement of the dog is difficult or dog abutment occurs during engagement of the dog.~~

~~[0024]~~

~~The actuation force transmission mechanism constructed as described above can slide in linear directions, and hence is compact in size and facilitates the choice of the installation location. The position of the shift actuator relative to the shift shaft can be determined arbitrarily.~~

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] ~~Brief Description of Drawings~~

~~[0025]~~

~~FIGs~~Figures~~.~~ 1(a) and 1(b) are ~~conceptual~~ schematic diagrams showing the basic structure of an actuation force transmission mechanism according to an embodiment of the present invention.

[0019] Figures ~~FIGs.~~ 2(a) to 2(e) show ~~how~~ exemplary operation of ~~an~~ the actuation force transmission mechanism of Figure 1(a) ~~10~~ with ~~operates when~~ a shift actuator ~~is stroked by a predetermined amount~~ in accordance with an embodiment of the present invention.

[0020] Figures ~~FIGs.~~ 3(a) to 3(g) show a specific structure and operation of the actuation force transmission mechanism ~~10~~ in accordance with an embodiment of the present invention.

[0021] Figure ~~FIG.~~ 4 is a graph showing the rotational angle of a shift shaft versus the stroke length of the shift actuator in accordance with another embodiment.

[0022] Figure ~~FIG.~~ 5 shows how a neutral position ~~is~~ can be set using coil springs of different urging forces in accordance with an embodiment of the present invention.

[0023] Figure ~~FIG.~~ 6 is a side view of a two-wheeled motor vehicle in accordance with an embodiment of ~~in~~ the present invention.

[0024] Figure ~~FIG.~~ 7 is a plan view of an embodiment of an engine provided with the shift actuator~~, etc., in the present invention~~.

[0025] Figure ~~FIG.~~ 8 is a side view of the engine provided with the shift actuator in accordance with an embodiment of ~~, etc., in~~ the present invention.

[0026] Figure ~~FIG.~~ 9 is an exploded perspective view of an embodiment of a transmission mechanism ~~in the present invention in the present invention~~.

[0027] Figure ~~FIG.~~ 10 shows the developed shape of grooves in a shift cam in accordance with an embodiment of ~~in~~ the present invention.

[0028] Figure ~~FIG.~~ 11 is a side view of an embodiment of the shift actuator ~~, etc., in the present invention~~.

[0029] Figure ~~FIG.~~ 12 shows an embodiment of an actuation force transmission mechanism ~~according to an embodiment of the present invention~~ in a normal state, in which Figure ~~FIG.~~ 12(a) is a plan view of the actuation force transmission mechanism, Figure ~~FIG.~~ 12(b) is a sectional view taken along the line B-B of Figure ~~FIG.~~ 12(a), and Figure ~~FIG.~~ 12(c) is a sectional view taken along the line C-C of Figure ~~FIG.~~ 12(a).

[0030] Figure ~~FIG.~~ 13 shows an embodiment of the actuation force transmission mechanism ~~according to the embodiment of the present invention~~ in ~~the~~ a ~~shortest~~ shortened state, in which Figure ~~FIG.~~ 13(a) is a plan view of the actuation force transmission mechanism, and Figure ~~FIG.~~ 13(b) is a sectional view corresponding to Figure ~~FIG.~~ 13(a).

[0031] Figure ~~FIG.~~ 14 shows an embodiment of the actuation force transmission mechanism ~~according to the embodiment of the present invention~~ in ~~the~~ an ~~longest~~ expanded state, in which Figure ~~FIG.~~ 14(a) is a plan view of the actuation force transmission mechanism, and Figure ~~FIG.~~ 14(b) is a sectional view corresponding to Figure ~~FIG.~~ 14(a).

[0032] Figure ~~FIG.~~ 15 shows an embodiment of the actuation force transmission mechanism ~~according to the embodiment of the present invention~~ in a divided state.

[0033] Figure ~~FIG.~~ 16 shows the structure of an embodiment of an actuation force transmission mechanism ~~in another embodiment of the present invention~~.

[0034] Figures ~~FIGs.~~ 17(a) and 17(b) show the structure of another embodiment of an actuation force transmission mechanism ~~in still another embodiment of the present invention~~.

[0035] Figure ~~FIG.~~ 18 is a block diagram showing an engine control unit ~~, etc.,~~ in accordance with an embodiment of ~~in~~ the present invention.

~~Description of Reference Numerals and Symbols~~

~~[0026]~~

~~10: actuation force transmission mechanism~~

~~11a: first coupling part~~

~~11b: second coupling part~~

~~12: urging means~~

~~12a: first urging means (coil spring)~~

~~12b: second urging means (coil spring)~~

~~13: stopper mechanism~~

~~13a: first stopper mechanism (stopper member)~~

~~13b: second stopper mechanism (stopper member)~~

~~15: support member~~

~~16a: first opening~~

~~16b: second opening~~

~~151: engine~~

~~152: engine case~~

~~155: speed change mechanism~~

~~156: shift fork~~

~~157: slide rod~~

~~158: shift cam~~

~~159: shift shaft~~

~~160: ratchet mechanism~~

~~161: shift arm~~

~~162: stopper plate~~

~~164: actuation force transmission mechanism~~

~~165: shift actuator~~

~~166: pinion gear~~

~~167: coupling rod~~

~~179: first coupling part~~

~~180: second coupling part~~

~~181: coil spring (urging means)~~

~~182: stopper member (stopper means)~~

~~183: support shaft~~

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0036] ~~Referring~~With reference now to the drawings wherein the figures are provided for purposes of illustrating preferred embodiments of the present invention and not for purposes of limiting the same, FIGS. 1-3 illustrate embodiments of ~~Best Mode for Carrying Out the Invention~~

~~[0027]~~

~~Before starting the description of specific structures of~~ an actuation force transmission mechanism. A basic description of the actuation force transmission mechanism will be provided first, followed by a detailed description of specific structures ~~of the present invention, the basic concept of the present invention is first described with reference to FIGs. 1 to 3~~utilizable in accordance with embodiments of the present invention.

[0037] ~~[0028]~~

~~FIGs.~~FIGS. 1(a) and 1(b) are ~~conceptual~~ schematic diagrams showing the basic structure of an embodiment of the actuation force transmission mechanism 10 ~~according to the present invention~~. FIG. 1(a) shows an arrangement of a biasing mechanism with ~~one~~ a single ~~urging means~~biasing member, and FIG. 1(b) shows an arrangement of a biasing mechanism with two ~~urging means~~biasing members. Normally, the shift actuator ~~is~~ can be coupled to the shift shaft through a coupling rod or the like. ~~The~~ In general, the shift actuator ~~is~~ can be stroked by a predetermined amount to rotate the shift shaft. The rotation of the shift shaft can engages and disengages a dog to control shift change. ~~T~~In an embodiment, the ~~subject~~ actuation force transmission mechanism 10 ~~is~~ can be disposed ~~at~~ on an arbitrary intermediate portion of the coupling rod.

[0038] ~~[0029]~~

~~The~~ embodiment of the actuation force transmission mechanism 10 shown in FIG. 1(a) includes a first coupling part 11a, a second coupling part 11b, ~~an urging means~~a

biasing mechanism 12, and a stopper mechanism 13. Thea first coupling part 11a and a the second coupling part 11b can be coupled for providing movement relative to each other in sliding directions. The , an urging meansbiasing mechanism 12 can be configured to for urgeing the first and second coupling parts 11a, 11b toward a neutral position. Finally, and a the stopper mechanism 13 can be configured for to stopping relative movement of the first or and second coupling part 11a, 11b when they move relative to each other from the neutral position against the an urging force of the urging meansbiasing mechanism 12.

[0039] ~~[0030]~~

~~Another embodiment of the~~ actuation force transmission mechanism 10, as shown in FIG. 1(b), has a structure similar to that shown in FIG. 1(a), but is provided with a biasing mechanism ~~n urging means~~ 12 and a ~~a~~ stopper mechanism 13 for each of the first and second coupling parts 11a, 11b. ~~T~~Thus, the first coupling part 11a ~~is~~ can be provided with a first ~~urging means~~biasing member 12a and a first stopper mechanism 13a for stopping relative movement of the first coupling part 11a in sliding directions~~,~~. In like manner,~~while~~ the second coupling part 11b ~~is~~ can be provided with a second ~~urging means~~biasing member 12b and a second stopper mechanism 13b for stopping relative movement of the second coupling part 11b in sliding directions. As discussed below, the ~~urging means~~biasing members can be a resilient component variously sized and configured to assist in the return the first and second coupling parts 11a, 11b to or from the neutral position. Further, the stopper ~~means~~ can also be variously sized and configured to assist in limiting the movement of the first and second coupling parts 11a, 11b. The operation of the actuation force transmission mechanism 10 shown in FIG. 1(b) is similar to that of the actuation force transmission mechanism 10 shown in FIG. 1(a), and hence only the latter is described here.

[0040] ~~[0031]~~

~~Now~~According to implementations of the present invention, the operation of the above actuation force transmission mechanism 10 is now described with reference to ~~FIGs~~ FIGS. 2(a) to 2(e). ~~The operation of the actuation force transmission mechanism 10 shown in FIG. 1(b) is basically the same as that of the actuation force transmission mechanism 10 shown in FIG. 1(a), and hence only the latter is described here.~~

~~[0032]~~

~~FIGs.~~FIGS. 2(a) to 2(e) show how the actuation force transmission mechanism 10 can operates when the shift actuator is stroked by a predetermined amount.

[0041] ~~[0033]~~

~~FIG.~~ 2(a) shows a state in which the first coupling part 11a and the second coupling part 11b are held at the neutral position of the actuation force transmission mechanism 10 by the urging force of the ~~urging means~~biasing mechanism 12. After the shift actuator is stroked by a predetermined amount and a shift up or a shift down is completed, the shift actuator can returns to a predetermined position. If the first and second coupling parts 11a, 11b deviate from the neutral position ~~is deviated~~ at that time, however, the dog can become ~~is~~ disengaged and may subsequently be engaged at deviated positions by the rotation of the shift shaft at the next shift up or shift down. This condition ~~, which~~ may hinder smooth shift change. ~~Thus~~However, the urging force of the ~~urging means~~biasing mechanism 12 ~~needs to be~~ can be preset such that the first and second coupling parts 11a, 11b ~~neutral position will~~ can be prevented from deviating from the neutral position.

[0042] ~~[0034]~~

~~W~~~~Referring~~With reference still to FIGS. 2(a)-(e), when the shift actuator in this state is actuated ~~based~~ in response to~~on~~ a gear change command signal, and starts being stroked by a predetermined amount, an actuation force F1 in the direction of the arrow (labeled F) ~~is~~ can be applied to the actuation force transmission mechanism 10 from the shift actuator side (the right side of the drawing) as shown in FIG. 2(a). At this time, when some resistive force R1 (which will be described specifically later) acts against movement of the actuation force transmission mechanism 10 on the shift shaft side (the left side of the drawing) of the actuation force transmission mechanism 10, the ~~urging means~~biasing mechanism 12 (e.g. a compression spring) ~~is~~ can be compressed, and as a result, the first coupling part 11a can moves relatively from ~~the~~ a ~~central~~ neutral position, as shown in FIG. 2(a)~~(b)~~, to a position shown in FIG. 2(b). As also shown, ~~T~~the first coupling part 11a can moves relatively against the ~~urging means~~biasing mechanism 12 until ~~it~~ the movement of the first coupling part 11a is stopped by action of the stopper mechanism 13, as shown in FIG. 2(b).

[0043] ~~[0035]~~

——————When the ~~relative~~ movement of the first coupling part 11a relative to the second coupling part 11b is stopped, ~~then~~ the first coupling part 11a and the second coupling part 11b can move together as shown in FIGS. 2(b)-(c). At this time, the actuation force transmission mechanism 10 can moves in ~~as it were~~ a "rigid" state and ~~hence~~ can therefore be enabled to ~~can~~ move against the resistive force R1 to effectively rotate the shift shaft.

[0044] ~~[0036]~~

——————When the resistive force R1 is no longer applied against the movement of the actuation force transmission mechanism 10, as shown in FIG. 2(d), the urging force of the ~~urging means~~biasing mechanism 12 can urges the first coupling part 11a toward the neutral position, and the actuation force transmission mechanism 10 can keeps moving as the shift actuator is stroked.

[0045] ~~[0037]~~

——————Then, when some resistive force R2 (which will be described specifically later) acts against the movement of the actuation force transmission mechanism 10 again, the ~~urging means~~biasing mechanism 12 can be ~~is~~ compressed as shown in FIG. 2(~~d~~e), and as a result, the first coupling part 11a can moves relatively against the ~~urging means~~biasing mechanism 12 to a point before it is stopped by the stopper mechanism 13 in the same way as in FIG. 2(b). When the relative movement of the first coupling part 11a is stopped, the second coupling part 11b can be ~~is~~ urged by the ~~urging means~~biasing mechanism 12 against the resistive force R2. Without the resistive force R2, the second coupling part 11b can be ~~is~~ moved by the urging force of the ~~urging means~~biasing mechanism 12.

[0046] ~~[0038]~~

——————As described above, when some resistive force acts against movement of the actuation force transmission mechanism 10 in which the first coupling part 11a and the second coupling part 11b are coupled to each other, the ~~urging means~~biasing mechanism 12 and the stopper mechanism 13 can work in conjunction with each other to relatively move the first coupling part 11a (or the second coupling part 11b) for a certain period in order to relieve the resistive force. After the certain period, the first coupling part 11a and the second coupling part 11b can move together to allow the actuation force of the shift actuator to act directly on the shift shaft.

[0047] ~~[0039]~~

~~The~~ The above description describes a typical example of the operation of the transmission mechanism 10. The operation of the actuation force transmission mechanism 10 can ~~may~~ vary depending on the magnitude and duration of resistive force which acts on the actuation force transmission mechanism 10, the stroke length of the shift actuator, etc.

[0048] ~~[0040]~~

~~For~~ For example, in the case where the resistive force R1 is applied to the actuation force transmission mechanism 10 of the above example for only a short period, the compression of the ~~urging means~~biasing mechanism 12 may not move the first coupling part 11a far enough relative~~ly~~ to the second coupling part 11b to cause the first coupling part 11a ~~before it is~~ to be stopped by the stopper mechanism 13. Instead, ~~but may allow~~ the first coupling part 11a ~~to~~ can return toward the neutral position when the resistive force R1 is no longer applied.

[0049] ~~[0041]~~

~~In~~ In the case where the shift actuator is stroked in the opposite direction, the actuation force transmission mechanism 10 can basically performs the same operation as shown in ~~FIGs.~~FIGS. 2(a) ~~to~~ 2(e). In such a case, ~~since~~ the actuation force transmission mechanism 10 could has~~ve~~ a ~~target~~ symmetrical structure with respect to the neutral position.

[0050] ~~[0042]~~

~~In~~ In the operation of the actuation force transmission mechanism 10 of the above example, the first coupling part 11a and the second coupling part 11b can be ~~are~~ coupled so as ~~so as~~ to be movable relative to each other in sliding directions. However, the first coupling part 11a and the second coupling part 11b can also ~~may~~ be coupled so as to be ~~startable~~ movable relative to each other in rotating directions.

[0051] ~~[0043]~~

~~The~~ The foregoing describes exemplary ~~the~~ conceptual structures and operations of ~~the~~ embodiments of the actuation force transmission mechanism 10. Now, exemplary ~~a~~ specific structures and operations of embodiments of the actuation force transmission mechanism 10 are described in association with actual engagement and disengagement of the dog with reference to ~~FIGs.~~FIGS. 3 and 4 ~~and 3~~.

[0052] ~~[0044]~~

~~FIGs.~~FIGS. 3(a)~~ to~~ 3(g) show exemplary ~~the~~ operation of an embodiment of the actuation force transmission mechanism 10 and ~~the~~ exemplary operation of an embodiment of a dog mechanism. FIG. 4 shows the rotational angle of the shift shaft versus the stroke length of the shift actuator, according to an implementation of the present invention. ~~The~~ According to one embodiment, the actuation force transmission mechanism 10 ~~described here~~ can hasve first and second coupling parts that each have an urging mechanism and a stopper mechanism ~~separately for the first and second coupling parts~~. However, its basic operation is the same as an actuation force transmission mechanism with one ~~urging means~~biasing member and one stopper mechanism.

[0053] ~~[0045]~~

~~The~~ right side of FIG. 3(a) shows an embodiment of the actuation force transmission mechanism 10 with the first coupling part 11a and the second coupling part 11b held in the neutral position. The~~, and the~~ left side of FIG. 3(a) shows an embodiment of the dog mechanism with a dog 20 engaged with a gear 21.

[0054] As shown in FIG. 3(a), ~~[0046]~~

~~T~~the first coupling part 11a of the actuation force transmission mechanism 10 ~~is~~ can be inserted into an opening of, and ~~thus~~ slideably coupled to the second coupling part 11b. A first coil spring 12a can act as ~~as~~ a biasing member, ~~n urging means,~~ and along with ~~and~~ a first stopper member 13a, can be ~~are~~ disposed in an opening 16a of the first coupling part 11a. Likewise, a second coil spring 12b can act as ~~an urging means~~a biasing member, and along with a second stopper member 13b, ~~are~~ can be disposed in an opening 16b of the second coupling part 11b.

[0055] ~~[0047]~~

~~When~~ a gear change command signal is input to the shift actuator in this state, the shift actuator can subsequently be ~~starts being~~ stroked by a predetermined amount. ~~The Referring~~As seen in ~~now to~~ FIG. 4, the shift shaft normally has "play" and can thus rotates by the play when the shift actuator is first stroked (represented by the diagonal line on the graph intermediate numbers 1 ~~to~~ and 2 on the horizontal axis of FIG. 4).

[0056] ~~[0048]~~

———As the shift actuator is further stroked, disengagement of the dog can starts. ~~Since~~ The frictional force of the dog 20 in engagement with the gear 21 can acts as resistive force against the movement of the shift actuator, as shown in FIG. 3(b~~),~~). Thus, according to an implementation of the present invention, the actuation force transmission mechanism 10 interposed between the shift actuator and the shift shaft can operates in such a way that:~~-~~ the first coil spring 12a ~~provided~~ disposed in the first coupling part 11a ~~is~~ can become compressed. A~~, and~~ as a result, the second coupling part 11b can moves relatively from the ~~central~~ neutral position.

[0057] Additionally, ~~[0049]~~

~~T~~the second coupling part 11b can moves relatively against the first coil spring 12a until the first stopper mechanism 13a comes in contact with the sidewall of a support member 15 of the second coupling part 11b. While the support member 15 abuts the first stopper mechanism 13a, the first coupling part 11a and the second coupling part 11b are in a "rigid" state; ~~T~~the shift shaft does not rotate as the shift actuator is stroked during this stage of stroke (represented by the horizontal line on the graph intermediate numbers ~~number~~ 2 ~~to~~and 3 on the horizontal axis of FIG. 4).

[0058] ~~[0050]~~

~~W~~Furthermore, when the relative movement of the second coupling part 11b is stopped, ~~then~~ the first coupling part 11a and the second coupling part 11b can move together as shown in FIG. 3(~~c~~c). At this time, since the actuation force transmission mechanism 10 moves in as it were a "rigid" state, the actuation force of the shift actuator is applied directly to the shift shaft and exceeds the above-described frictional force so that the dog 20 disengages from the gear 21 during this stage of stroke (represented by the diagonal line on the graph intermediate numbers ~~number~~ 3 ~~to~~ and 4 on the horizontal axis of FIG. 4).

[0059] ~~[0051]~~

———When the dog 20 is completely disengaged, frictional force of the dog 20 with the gear 21 no longer exists. Thus, the urging force of the first coil spring 12a can then returns the second coupling part 11b toward the neutral position as shown in FIG. 3(d). After the dog 20 is disengaged, the shift shaft can rotates with almost no resistive force acting against the movement of the actuation force transmission mechanism 10 (represented by the

diagonal line on the graph intermediate numbers ~~number 4~~ to 5 on the horizontal axis of FIG. 4).

[0060] ~~[0052]~~

~~—————~~Then, as shown in FIG. 3(e), resistive force due to abutment of the dog acts against the movement of the shift actuator when the dog 20 engages with a gear 22. Again, as shown in FIG. 3(f), the first coil spring 12a ~~provided~~ disposed in the first coupling part 11a ~~is~~ can become compressed, and ~~as a result~~ the second coupling part 11b can then moves relatively from the ~~central~~ neutral position. In the abutment of the dog 20, small urging force of the first coil spring 12a acts on the dog 20, and allows the dog 20 to engage with the gear 22 smoothly (represented by the horizontal line on the graph intermediate numbers ~~number 5 to~~ and 6 on the horizontal axis of FIG. 4). ~~When~~ Once the dog 20 is completely engaged with the gear 22, there no longer exists resistive force as shown in FIG. 3(g). Thus, the urging force of the first coil spring 12a can returns the second coupling part 11b toward the neutral position.

[0061] ~~[0053]~~

~~—————~~Preferably, a gap ~~may~~ can be provided so that the second coupling part 11b will move relatively not to be stopped by the first stopper mechanism 13a when the shift actuator is fully stroked and in the abutment of the dog, as shown in FIG. 3(f).

[0062] ~~[0054]~~

~~—————~~As described above, an embodiment of the actuation force transmission mechanism 10 ~~of the present invention~~ can include~~ing~~ a first coupling part 11a and a second coupling part 11b, and can be ~~-~~coupled ~~for~~ so as to provide movement relative to each other. Further, the actuation force transmission mechanism 10 can be ~~is~~ interposed between the shift actuator and the shift shaft. When the shift actuator is stroked by a predetermined amount, the dog ~~is~~ can be compulsorily disengaged as the first and second coupling parts 11a, 11b are moved together by ~~means of~~ the stopper mechanism 13 (13a, 13b). Further, the dog can be ~~,~~ ~~and~~ engaged (in the abutment of the dog) as the one of the first ~~or~~ and second coupling part ~~is~~ 11a, 11b is moved relatively against the urging force of the ~~urging means~~biasing mechanism 12 (~~13a~~12a, ~~13b~~12b). This ~~allows~~ can facilitate smooth shift change.

[0063] ~~[0055]~~

~~———————~~In the above description, the dog ~~is~~ can be disengaged as the first and second coupling parts move together. However, it should be understood that the dog can be successfully disengaged as one of the first ~~or~~ and second coupling parts movess relatively, such as when ~~in the case where~~ the frictional force of the dog is small.

[0064] ~~———————[0056]~~

~~———————T~~According to an implementation, the actuation force transmission mechanism ~~constructed as described above~~ can slide independently of an existing shift control device. ~~, and h~~Hence, the position of the shift actuator relative to the shift shaft can be determined arbitrarily.

[0065] ~~———————[0057]~~

~~———————~~In addition, according to another implementation, the actuation force transmission mechanism 10 ~~described above~~ can be easily disposed outside the engine case. For example, ~~when~~ the actuation force transmission mechanism 10 ~~is~~ can be held by a coupling rod coupled to the shift actuator and the shift shaft. Further, the actuation force transmission mechanism 10 ~~described above~~ can be effectively protected from water and dust by disposing it in a case held by the coupling rod.

[0066] ~~———————[0058]~~

~~———————~~In the case where the urging forces of the first and second coil springs 12a, 12b ~~provided in the first coupling part 11a and the second coupling part 11b~~ are the same ~~in the actuation force transmission mechanism 10 shown in FIG. 3~~, the neutral position can be easily set ~~comparatively easily~~. However, ~~in the case where~~ if the urging forces are ~~intentionally~~ different, the neutral position ~~must~~ should be set carefully. With reference now to FIG. 5, ~~Now,~~ description will be made of how the neutral position ~~is~~ can be set using coil springs 12a, 12b ~~of~~ that have different urging forces ~~with reference to FIG. 5~~.

[0067] ~~———————[0059]~~

~~———————~~As shown in FIG. 5(a), the free length of the first coil spring 12a (spring constant: N1) provided in the first coupling part 11a is defined as L1, and the free length of the second coil spring 12b (spring constant: N2) provided in the second coupling part 11b is defined as L2. Assuming that the first coupling part 11a and the second coupling part 11b of

FIG. 5(b) are in the neutral position, and also the lengths of the first coil spring 12a and the second coil spring 12b are respectively x and y, the following equations hold true:

$$x + y + a = z \quad (1)$$

$$N1 \times (L1 - x) = N2 \times (L2 - y) \quad (2)$$

[0068] The length x of the first coil spring 12a and the length y of the second coil spring 12b can be determined by solving these simultaneous equations (1), (2).

[0069] ~~[0060]~~

~~The~~ basic structure of the actuation force transmission mechanism according to embodiments of the present invention has been described above. Hereinafter, specific structures and operations of various embodiments thereof will be described in detail with reference to FIGS. 6~~ to FIG.~~ 17.

[0070] ~~[0061]~~

~~FIG.~~ 6 is a side view of a two-wheeled motor vehicle to which the actuation force transmission mechanism ~~of the present invention is~~ can be applied in accordance with an implementation of embodiments of the present invention. In FIG. 6, reference numeral 140 denotes a two-wheeled motor vehicle as a "straddle-type vehicle", which can be provided with a front wheel 141 on its front side, a rear wheel 142 on its rear side, a fuel tank 144 in rear of handlebars 143, a seat 145 in rear of the fuel tank 144, and an engine 151 supported by a body frame below the fuel tank 144 and the seat 145.

[0071] ~~[0062]~~

~~A~~ transmission (not shown) ~~is~~ can be disposed in an engine case 152 for the engine 151. The transmission ~~has~~ can have four to six speeds and adopts a dog clutch. Power from a crankshaft of the engine 151 ~~is~~ can be transmitted to a main axle, and then to a drive axle via gears and dogs for respective speeds.

[0072] ~~[0063]~~

~~Speed~~ change operation of the transmission ~~is~~ can be achieved by a speed change mechanism 155, ~~such as shown~~ an embodiment of which is shown in FIG. 9. ~~The~~ As shown in FIG. 9, the speed change mechanism 155 can includes shift forks 156 for regularly moving slide gears of the transmission, slideably mounted on a slide rod 157, and a rotatable shift cam 158 for sliding the shift forks 156.

[0073] ~~[0064]~~

~~Cam~~ Cam grooves 158a ~~are~~ can be formed on the periphery of the shift cam 158. When developed, the cam grooves 158a ~~are~~ can be formed as shown in the exemplary embodiment of FIG. 10. The shift forks 156 ~~are~~ can be adapted to slide along the cam grooves 158a.

[0074] ~~[0065]~~

~~T~~According to an embodiment, the shift cam 158 can rotates via a ratchet mechanism 160 as a shift shaft 159 rotates. The ratchet mechanism 160 can be configured to provide a ratchet function for both forward and reverse directions to change one gear at a time. For example, the ratchet mechanism 160 can rotates the shift cam 158 with constant intervals (such as by a constant angle) to move the shift forks 156 regularly~~, or in other words has a ratchet function for both forward and reverse directions to change one gear at a time~~. A shift arm 161 of the ratchet mechanism 160 can transmits rotation of the shift shaft 159, and can also restricts the stroke of shift shaft 159 in order to prevent the shift cam 158 from overrunning. A stopper plate 162 of the ratchet mechanism 160 can be utilized to keeps the shift cam 158 in specified positions.

[0075] ~~[0066]~~

~~The~~ The shift shaft 159 can moves rotationally in a predetermined direction through a device, such as described below.

[0076] ~~Referring~~With reference to the embodiment illustrated in FIG. 7, ~~[0067]~~

~~A~~a distal end 159a of the shift shaft 159 can projects from the engine case 152 to the outside of the engine, and ~~is~~ can be coupled to an end 167b of a coupling rod 167. An actuation force transmission mechanism 164 ~~is~~ can be disposed at an intermediate portion of the coupling rod 167. The shift shaft 159 ~~is~~ can be rotated by driving force of the shift actuator 165 via the actuation force transmission mechanism 164.

[0077] ~~[0068]~~

~~As~~ As shown in ~~FIGs.~~ FIGS. 7 and 8, the shift actuator 165 ~~is~~ can be disposed on a side of the upper part of the engine case 152 along the longitudinal direction of the vehicle. As shown in FIG. 11, the shift actuator 165 ~~is~~ can be provided with a ~~warm~~ worm

gear 165a at the distal end of its rotary shaft. The worm ~~warm~~ gear 165a ~~is~~ can be configured to ~~meshed~~ with a pinion gear 166. A coupling shaft 166a ~~is~~ can be provided eccentrically with respect to the center axis of the pinion gear 166.

[0078] ~~[0069]~~

~~T~~Referring~~As~~ seen in ~~again to~~ FIG. 7, ~~he~~ one end 167a of the coupling rod 167 extending vertically ~~is~~ can be coupled to the coupling shaft 166a for free rotation. Additionally ~~as shown in FIG. 7~~, ~~while~~ the other end 167b of the coupling rod 167 ~~is~~ can be coupled to the shift shaft 159, as shown in FIG. 8.

[0079] ~~[0070]~~

~~As~~ shown in the embodiment illustrated in FIG. 8, the actuation force transmission mechanism 164 can be coupled to the coupling rod 167 and ~~may~~ can be covered by a case 190 ~~and~~ in order to be ~~thereby~~ protected from water and dust.

[0080] ~~[0071]~~

~~As~~ shown in the embodiments illustrated in ~~FIGs.~~FIGS. 12 to 15, the actuation force transmission mechanism 164 ~~is~~ can also be provided with first and second coupling parts 179, 180 ~~slidably~~ that move~~movable~~ relative to each other in linear directions. More preferably, the first and second coupling parts 179, 180 slide relative to each other. ~~A~~ In such an embodiment, a coil spring 181, which is used ~~as~~ the~~a~~ biasing member of the biasing mechanism, ~~a "urging means,"~~ and a stopper member 182 ~~are~~ can be disposed between the first and second coupling parts 179, 180.

[0081] ~~[0072]~~

~~As~~ shown in the embodiment of FIG. 15, the first coupling part 179 can includes a base part 179a, and a pair of plate parts 179b, which can be fixed to the base part 179a with a constant interval. ~~The~~ In accordance with an implementation of such an embodiment, the two plate parts 179b ~~are~~ can be formed with an opening 179c where the coil spring 181 and the stopper member 182 are disposed. Further, ~~and~~ the two plate parts 179b can also include ~~with~~ a coming-off prevention piece 179d for preventing the coil spring 181 and the stopper member 182 from coming off.

[0082] ~~[0073]~~

———Also as shown in FIG. 15, the second coupling part 180 can includes a base part 180a, and a single plate part 180b fixed to the base part 180a. The single plate part 180b can be inserted between the pair of plate parts 179b of the first coupling part 179. The plate part 180b ~~is~~ can also be formed with an opening 180c generally of the same size as the opening 179c of the plate parts 179b of the first coupling part 179.

[0083] ———[0074]

———The coil spring 181 ~~is~~ can be accommodated in the openings 179c, 180c of the respective plate parts 179b, 180b. Further, ~~and~~ the columnar stopper member 182 ~~is~~ can be disposed inside the coil spring 181. A support shaft 183 ~~is~~ can be slideably inserted through the stopper member 182, and disposed between the plate parts 179b.

[0084] ———[0075]

———With this structure, to shift down, for example, the shift actuator 165 ~~is~~ can be driven to move the first and second coupling parts 179, 180 of the actuation force transmission mechanism 164 in compressing directions. ~~, and t~~The coil spring 181 ~~is~~ can then be compressed against its urging force from the state shown in FIG. 12 to the state shown in FIG. 13. This urging force can rotates the shift shaft 159 to allow engagement or disengagement of the dog.

[0085] ———[0076]

———When the dog is to be engaged, there are cases where the dog contacts another dog due to bad timing and hence is not engaged immediately. Even in such cases, the dogs ~~are~~ can be subjected to comparatively small urging force of the coil spring 181 and hence ~~do~~ may not abut against each other with large force. Thus, the components ~~are~~ can be protected from damage or the like. After that, the slide gears can move rotationally slightly, and the urging force of the rotational movement can causes the dogs to be meshed with each other reliably.

[0086] ———[0077]

———As the coil spring 181 is elastically deformed and compressed, the opening 179c of the plate parts 179b and the opening 180c of the plate part 180b ~~are~~ can be displaced from each other. At the time when the first and second coupling parts 179, 180 have moved relatively by a predetermined amount in linear directions, the width of an opening common to

the displaced openings 179c, 180c can becomes coincident with the width of the stopper member 182. This can stops the relative movement of the first and second coupling parts 179, 180, and causes the first and second coupling parts 179, 180 to move rotationally together. Thus, even when the dog is engaged and difficult to be disengaged due to residual torque, the dog can be compulsorily disengaged.

[0087] ~~[0078]~~

~~On the other hand,~~ to shift up, for example, the shift actuator 165 ~~is~~ can be driven to relatively move the first and second coupling parts 179, 180 in separating directions. ~~—~~Then, the opening 179c of the plate parts 179b and the opening 180c of the plate part 180b ~~are~~ can be displaced from the generally coincident position, and the coil spring 181 ~~is~~ can be compressed. The urging force of the coil spring 181 can tend to ensures engagement of the dog, as described above.

[0088] ~~[0079]~~

~~Further from this state,~~ as the coil spring 181 is elastically deformed, the opening 179c of the plate parts 179b and the opening 180c of the plate part 180b ~~are~~ can be displaced from each other. At the time when the first and second coupling parts 179, 180 have moved relatively by a predetermined amount in separating directions, the width of an opening common to the displaced openings 179c, 180c can becomes coincident with the width of the stopper member 182. This can stops the relative movement of the first and second coupling parts 179, 186, and causes the first and second coupling parts 179, 180 to move rotationally together. Thus, even when the dog is engaged and difficult to be disengaged due to residual torque, the dog can be compulsorily disengaged.

[0089] It is contemplated that ~~[0080]~~

~~T~~the first coupling part 179, the second coupling part 180, and the stopper member 182 can be formed ~~of~~ in various ~~structures are conceivable~~configurations. Some exemplary embodiments~~amples~~ are shown in ~~FIGs.~~FIGS. 16~~,~~ and 17(a) ~~and 23(b)~~.

[0090] ~~[0081]~~

~~In the example~~ embodiment shown in FIG. 16, the second coupling part 180 ~~is~~ can be constituted of a rod, and the first coupling part 179 ~~is~~ can be constituted of a cylindrical member for accommodating a part of the rod. The coil spring 181, utilizable as a

biasing mechanism, ~~n urging means, is~~ can be disposed between the first coupling part ~~(cylindrical member)~~ 179 (shown as a cylindrical member) ~~-~~and the second coupling part ~~(rod)~~ 180 (shown as a rod). A sidewall 182a inside the first coupling part 179 and a step 182b can be provided on the inner surface of the first coupling part 179 to respectively serve as ~~stop~~ stopper members when the second coupling part 180 moves relative to the first coupling part 179.

[0091] ~~[0082]~~

~~For example, when the second coupling part 180 moves relative to the first coupling part 179 toward the right side of FIG. 16, the coil spring 181 is~~ can be compressed by a ~~cir~~circle-clip 190b embedded in a portion of the first coupling part 179. The second coupling part 180 can moves relatively until its distal end contacts the sidewall ~~(stop member)~~ 182a (utilizable as a stopper member) ~~-~~inside the first coupling part 179.

[0092] ~~[0083]~~

~~Also, when the second coupling part 180 moves relative to the first coupling part 179 toward the left side of FIG. 16, the coil spring 181 is~~ can be compressed by a ~~cirelip~~circle-clip 190a embedded in a portion of the first coupling part 179. The second coupling part 180 can moves relatively until the ~~cirelip~~circle-clip 190b embedded in a portion of the first coupling part 179 contacts the step (~~stop~~ stopper member) 182b provided on the inner surface of the first coupling part 179.

[0093] ~~[0084]~~

~~The rod and the cylindrical member constituting the first coupling part 179 and the second coupling part 180 may~~ can be of a circular, rectangular or any other shape as long as the cylindrical member can accommodate the rod. The rod ~~may~~ can have portions of different diameters, and a portion of a large diameter may be used as a part contacted by the spring.

[0094] ~~[0085]~~

~~In addition, the cylindrical member may~~ can be constituted with plural members having inner and outer surfaces. For example, the cylindrical member ~~may~~ can be constituted with plural semi-cylindrical members divided along the linear direction of the rod. ~~In this case, the cylindrical member includes plural cylindrical members.~~

[0095] ~~[0086]~~

~~I~~As illustrated in the example shown in FIG. 17(a), the distal end of the first coupling part 179 ~~is~~ can be bent back and inserted into an opening of the second coupling part 180. Sidewalls 182a, 182b of the opening ~~are~~ can be used as stopper members. In the example shown in FIG. 17(b), a coil spring 181 is provided in an opening defined by the first coupling part 179 and the second coupling part 180. A projection 182a formed on the first coupling part 179 and a recess 182b formed in the second coupling part 180 ~~are~~ can be fitted to each other to serve as stopper members.

[0096] ~~[0087]~~

~~In~~ In these examples, the first coupling part 179 and the second coupling part 180 ~~are~~ can be arranged such that their distal ends overlap each other in linear directions.

[0097] ~~Referring~~With reference now to ~~[0088]~~

~~FIG. 18, an embodiment is shown of shows the~~ a structure for drive control of the two-wheeled motor vehicle that incorporates~~ing~~ the actuation force transmission mechanism 164 ~~of the present invention~~as taught in accordance with an implementation of the present invention.~~.~~

[0098] ~~[0089]~~

~~As~~ As shown in FIG. 18, an embodiment of an engine control unit 210 for controlling the engine 151 is provided. In accordance with an implementation of the embodiment, various components can be connected ~~T~~to the engine control unit 210; such components can include: ~~are connected~~ an engine speed sensor 211, a vehicle speed sensor 212, a clutch actuator position sensor (potentiometric sensor) 213, a shift actuator position sensor 214, a gear position sensor 215, an UP switch 216 for shifting up, and a DOWN switch 217 for shifting down. Detected values and operation signals from these components ~~are~~ can be input to the engine control unit 210. ~~The~~ In a preferred embodiment, the UP switch 216 and the DOWN switch 217 ~~are~~ can be provided on the handlebars 143.

[0099] ~~[0090]~~

~~T~~As also shown in FIG. 18, the engine control unit 210 ~~is~~ can be connected to a clutch actuator 218, the shift actuator ~~265~~165, a gear position display section

219, an engine ignition section 220, and a fuel injection device 221, which ~~are~~ can be driven and controlled based on the signals from the various sensors 211, etc.

[0100] ~~[0091]~~

~~The~~ The signals from the UP switch 216, the DOWN switch 217, the shift actuator position sensor 214, the gear position sensor 215, etc., ~~are~~ can be input to the engine control unit 210, and control signals from the engine control unit 210 ~~are~~ can be used to drive and control the shift actuator 165.

[0101] ~~[0092]~~

~~Although the present invention has been described above by way of preferred embodiments, the above descriptions should not be construed as limitations, but various modifications may be made.~~

~~[0093]~~

The shift control device in embodiments of the present invention ~~may~~ can be mounted on a two-wheeled motor vehicle, as shown in FIG. 6, in order to allow smooth shift change when the two-wheeled motor vehicle is running.

[0102] ~~[0094]~~

The term "two-wheeled motor vehicle" used herein can include ~~means~~ motorcycles ~~including~~ such as motorized bicycles (motorbikes) and scooters, and refers specifically to vehicles ~~which can be~~ whose turning can include ~~ed by~~ tilting of the vehicle body. Thus, a vehicle having two or more front wheels and/or two or more rear wheels, and hence having a total of at least three ~~or four (or more)~~ wheels, can also be included in the "two-wheeled motor vehicle". The embodiments of the present invention ~~is~~ are not limited to use in two-wheeled motor vehicles, but may also be applied to other vehicles which can take advantage of the effect of the embodiments the present invention. Examples of such vehicles include the so-called straddle-type vehicles other than two-wheeled motor vehicles, such as four-wheeled buggies (all terrain vehicles (ATVs)) and snowmobiles.

[0103] ~~[0095]~~

~~T~~Further, the "shift actuator" ~~may~~ can be of an electric or hydraulic type. Instead of coil spring, the "~~urging means~~biasing member" ~~may~~ can be another type of spring, or an elastic member such as rubber, resin, etc.

[0104] ~~[0096]~~

~~When~~ embodiments of the present invention ~~is~~ are to be applied to actual straddle-type vehicles, specific implementations should be examined from a comprehensive viewpoint which allows for each and every requirement in order to produce an excellent effect such as described above.

~~Industrial Applicability~~

~~[0097]~~

~~An object of the present invention is to provide~~ Further, such implementations preferably facilitate easy installation and maintenance of embodiments of the ~~an~~ actuation force transmission mechanism ~~that is easy to install and maintain~~.

[0105] -Although the embodiments of the present invention have been disclosed in the context of certain preferred embodiments and examples, it will be understood by those skilled in the art that the teachings herein extend beyond the specifically disclosed embodiments to other alternative embodiments and/or uses of the embodiments and obvious modifications and equivalents thereof. In addition, while several variations of the embodiments have been shown and described in detail, other modifications, which are within the scope of these embodiments, will be readily apparent to those of skill in the art based upon this disclosure. It is also contemplated that various combination or sub-combinations of the specific features and aspects of the embodiments may be made and still fall within the scope of the teachings herein. It should be understood that various features and aspects of the disclosed embodiments can be combined with or substituted for one another in order to form varying modes of the disclosed embodiments. Thus, it is intended that the scope of at least some of the present embodiments herein disclosed should not be limited by the particular disclosed embodiments described above.

WHAT IS CLAIMED IS:~~Claims~~

~~———~~An actuation force transmission mechanism for use ~~[1]——I~~in a shift control device for a straddle-type vehicle, the shift control device ~~for~~ performing shift control in which a shift actuator is stroked by a predetermined amount to rotate a shift shaft, the ~~actuation device~~force actuation transmission mechanism

1. ~~———an actuation force transmission mechanism~~ comprising:

~~———a~~ first and second coupling parts ~~and a second coupling part~~ being sized and configured to be coupled together to provide ~~for~~ relative movement in a linear direction, the first coupling part also being coupled to the shift actuator, and the second coupling part also being coupled to the shift shafts;

~~———~~a biasing mechanism ~~n urging means for~~ urging the first and second coupling parts toward a neutral position; and

~~———~~a stopper mechanism for stopping the relative movement of the first ~~or~~ and second coupling parts when the one of the first ~~or~~ and second coupling parts is moved ~~relatively~~ from the neutral position against urging force of the ~~urging means~~biasing mechanism.~~;~~

~~———wherein the actuation force transmission mechanism is interposed between the shift actuator and the shift shaft.~~

~~———~~

~~———~~~~[2]~~ The actuation force transmission mechanism according to Claim 1, wherein the actuation force transmission mechanism is arranged such that, when a resistive force acts linearly against the movement of the actuation force transmission mechanism, ~~:~~

~~———~~the first ~~or second~~ coupling part moves relative~~ly~~ to the second coupling part against the urging force of the ~~urging means~~biasing mechanism until the first ~~or second~~ coupling part is stopped by the stopper mechanism, and wherein in response to a continuing resistive force,~~; and~~

2. ~~———then~~ the first and second coupling parts moving~~e~~ together upon the first coupling part being stopped by the stopper mechanism.

3. ~~[3]~~ The actuation force transmission mechanism according to Claim 1, wherein the first coupling part comprises a cylindrical member and the second coupling part ~~are constituted of~~ comprises a rod, the ~~and a~~ cylindrical member including a cavity being sized and configured to ~~for accommodating~~receive at least a portion ~~part~~ of the rod therein.

~~[4]~~ The actuation force transmission mechanism according to Claim 3, wherein ~~:~~

t~~t~~he ~~urging means~~biasing mechanism includes a coil spring~~;~~, ~~and~~

4. the ~~urging means~~coil spring ~~is~~ being disposed ~~between~~ intermediate the rod and the cylindrical member for providing an urging force in the linear direction between the rod and the cylindrical member.

~~[5]~~ The actuation force transmission mechanism according to Claim 4, wherein ~~:~~

the rod ~~has~~ includes portions of different diameters~~;~~, ~~and~~

5. a ~~portion of a~~ large diameter portion thereof ~~is~~ being sized and configured to ~~used as a part~~ contacted ~~by~~ an end of the spring, the contact intermediate the large diameter portion of the rod and the spring facilitating the linear exertion of the urging force.

~~[6]~~ The actuation force transmission mechanism according to Claim 3, wherein~~:~~

the cylindrical member has a step on its inner surface~~;~~, ~~and~~

6. the step ~~is~~being ~~used~~ utilizable as a part of the stopper mechanism.

7. ~~[7]~~ The actuation force transmission mechanism according to Claim 3, wherein the cylindrical member ~~is constituted with~~ includes plural members having inner and outer surfaces.

8. ~~[8]~~ The actuation force transmission mechanism according to Claim 7, wherein the cylindrical member includes plural cylindrical ~~members~~segments.

9. ~~[9]~~ The actuation force transmission mechanism according to Claim 1, wherein the first ~~coupling part~~ and ~~the~~ second coupling parts define distal ends, the first and second coupling parts being ~~are~~ arranged ~~such that their~~ with the respective distal ends thereof overlapping each other in the linear directions.

10. ~~[10]~~ The actuation force transmission mechanism according to Claim 1, wherein the shift actuator is coupled to the shift shaft via a coupling rod, ~~and~~ the actuation force transmission mechanism ~~is being~~is disposed ~~at~~ along an intermediate portion of the coupling rod.

11. ~~[11]~~ The actuation force transmission mechanism according to Claim 10, wherein the actuation force transmission mechanism is provided in a case held by the coupling rod.

12. ~~[12]~~ The actuation force transmission mechanism according to Claim 1, wherein the actuation force transmission mechanism is disposed outside an engine case.

13. ~~[13]~~ A straddle-type vehicle incorporating the actuation force transmission mechanism ~~according to any one~~ of Claims 1 ~~to 12~~.

ACTUATION FORCE TRANSMISSION MECHANISM AND STRADDLE-TYPE VEHICLE

ABSTRACT OF THE DISCLOSURE~~Abstract~~

~~[Abstract]~~

~~[Problem to be Solved] To provide an actuation force transmission mechanism utilizing an existing shift control device that is easy to install and maintain.~~

~~[Solution]~~ An actuation force transmission mechanism ~~10~~ is provided that can be interposed between a shift actuator and a shift shaft. The mechanism ~~10~~ can include: ~~s: a~~ first and second coupling parts ~~11a and a second coupling part 11b~~ that can be coupled for movement relative to each other in sliding directions; ~~an urging means~~a biasing mechanism ~~12~~ that can be configured for urging the first and second coupling parts ~~11a, 11b~~ toward a neutral position; and a stopper mechanism ~~13~~ that can be configured for stopping relative movement of one of the first ~~or~~ and second coupling parts ~~11a, 11b~~ when ~~they~~ moved relatively ~~to each other~~ from the neutral position against ~~the~~ an urging force of the ~~urging means~~biasing mechanism ~~12~~. ~~The actuation force transmission mechanism 10 is arranged such that, w~~When the shift actuator is stroked by a predetermined amount~~:~~, the first ~~or second~~ coupling part can ~~11a, 11b~~ moves relative to the second coupling part~~ly~~ against the urging force ~~of the urging means 12~~ until the first ~~or second~~ coupling part ~~11a, 11b~~ is stopped by the stopper mechanism ~~13~~, at which point, ~~; and then~~ the first and second coupling parts ~~11a, 11b~~ can move together.

~~[Selected Drawing] FIG. 1~~

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